

Chapter 4

Conservation Actions to Address Barriers to Conservation and Stresses Affecting Species and Habitats

During the planning phase of the Nebraska Natural Legacy Project, conservation practitioners and the public were asked to help identify the barriers that limit or preclude conservation, key stresses to species and habitats, and actions needed to overcome barriers and stresses to species and habitats. Barriers, stresses and actions were identified by (1) the public at input meetings and through the Nebraska Annual Social Indicators Survey (NASIS), (2) conservation practitioners who participated in workshops and regional meetings, (3) species experts who attended a series of workshops, and (4) members of the public and conservation practitioners who provided comments during the review of the plan. Existing conservation plans were also reviewed and appropriate stresses, barriers and actions were incorporated into this plan.

Proposed conservation actions were run through a filter of guiding principles developed by the Natural Legacy Partnership Team to ensure they were biologically sound, economically feasible and sensitive to private landowner needs. Although most input was gathered on an ecoregional basis and specific barriers, stresses and conservation actions have differing levels of importance in each of Nebraska's four ecoregions, most have statewide relevance. Therefore, issues were incorporated into a single chapter to reduce redundancy. Key barriers, stresses and actions in each ecoregion and Biologically Unique Landscape are identified in ecoregion chapters.

The Natural Legacy Project uses voluntary, incentive based approaches to conservation. It does not evaluate existing state or federal regulatory programs that affect biological diversity (e.g., water or air quality regulatory programs, at-risk species protection laws). This strategy therefore does not provide recommendations for changes to regulatory programs that have been initiated already nor the need for additional such programs.

Because 97% of the state is in private ownership (principally farms and ranches), conservation of the state's flora and fauna is largely dependent upon support and participation by private landowners. Extensive public input helped ensure that proposed conservation actions were reasonable and practical. Economic feasibility should take into account the cost of conservation actions and direct impacts on local economies. Conservation actions should be evaluated considering costs and benefits for meeting conservation goals. With full implementation, the partnership and perspective of landowners is invaluable. Input from private landowners is sought continually throughout implementation.

The stresses and actions identified in the following section, along with the at-risk species, communities, and priority landscapes identified in Chapters 5-8, comprise the nucleus of the conservation blueprint. Implementation of the conservation actions on a statewide level will help ensure that a significant number of opportunities for conservation of biological diversity in Nebraska are acted upon.

Actions Needed to Overcome Barriers and Threats

- Increase collaboration and communication
- Increase environmental education
- Improve conservation programs and incentives
- Facilitate species and ecosystem adaptation to climate change
- Promote management that is more compatible with conserving biological diversity
- Focus conservation on the best opportunities
- Maintain and expand the network of public and private conservation lands
- Demonstrate success
- Increase participation in nature-based recreation

Advance Collaboration and Communication

No single government agency or private organization has the authority, financial resources, or staff to assume the entire responsibility for conserving Nebraska's biological diversity. Implementation of a state wildlife action plan requires the cooperative efforts of a wide range of governmental entities, private organizations and citizens. Partnerships and cooperative arrangements can be used to promote collaboration and communication. This approach should help reduce duplication, increase information sharing, establish trust, and promote more efficient allocation of resources to conservation priorities.

In the past, a lack of communication and collaboration between resource professionals and agricultural producers has created tension and conflict regarding fish and wildlife conservation. Many of these conflicts have arisen from issues related to endangered species, water management, and a perceived lack of respect for private property rights. As a result, trust has eroded and collaboration on a broader range of conservation issues has been impeded. Information about conservation opportunities to landowners is often insufficient or unclear. Many individuals who are interested in conservation programs may not be aware of conservation opportunities or know whom to contact.

82% of Nebraskan's feel that "at-risk" species would be conserved most effectively by a partnership of governmental and private organizations.

Source 2004 NASIS Survey

Communication amongst conservation practitioners is often inadequate. Without a consistent exchange of information and opportunities to collaborate, conservation practitioners run the risk of being uninformed about programs and species needs. Improved communication and collaboration between agencies and conservation practitioners can lead to greater efficiency and result in new and innovative solutions to conservation problems.

Actions Needed to Advance Collaboration and Communication:

Support existing locally-based conservation partnerships in each of Nebraska's ecoregions that include a diversity of stakeholders (e.g., farmers, ranchers, community leaders, public and private conservation organizations). When possible, any new partnerships should be modeled after existing successful partnerships (e.g., Sandhills Taskforce, Rainwater Basin Joint Venture).

1. Support existing and develop new regional forums that include diverse representation from landowners, agencies, private organizations and others that facilitate the exchange of ideas, promote networking, and engage in problem-solving to address issues related to endangered species management, public lands ownership and management, landowner confidentiality, private property rights, etc. Present Natural Legacy information at various forum meetings. Distribute local contact information and address concerns by conducting seminars, workshops, and social functions that promote communication, cooperation and the exchange of ideas.
2. Develop and widely distribute clear and concise publications about conservation programs, stresses to biological diversity, and actions needed to conserve biological diversity. Make it widely available in printed and electronic formats.
3. Regularly inform the public of proposed initiatives, management actions, policy changes, and conservation successes and failures through public meetings, workshops, field trips, one-on-one meetings, seminars, presentations at stakeholder meetings, media, and other effective venues.
4. Develop and implement recognition and appreciation programs to acknowledge the efforts of farmers, ranchers, acreage owners, organizations, community leaders, and others who demonstrate meritorious achievement in the conservation of biological diversity.
5. Design and conduct training programs that instruct conservation practitioners and others in effective public participation techniques.
6. Strive for shared responsibility between landowners, agencies, organizations, and communities when implementing the Nebraska Natural Legacy Project.
7. Institute a citizen-science and education initiative that draws on volunteers of all ages to assist with monitoring, research, stewardship, and education of natural habitats and wildlife. Opportunities are available with existing programs (e.g., Master Naturalist, Adopt-A-Stream, Project FeederWatch) and should be supported.
8. Improve existing and establish new communication channels among conservation practitioners and their agencies/organizations to improve coordination, reduce conflicting and confusing messages conveyed to the public, and to develop a shared vision for the conservation of biological diversity.

9. Facilitate conservation projects by communicating information about possible funding sources, trained contractors, and resources such as native seed suppliers. Encourage involvement in conservation programs, particularly featuring acres where producers are experiencing a decreased profit margin. In many cases, producers may realize no net loss from their participation in conservation programs.
10. Seek opportunities to facilitate understanding and collaboration between the rural and urban publics.
11. Establish networks between public land managers and neighboring private landowners to improve communication, increase respect, and build trust.
12. Look for opportunities to collaborate with bordering states to develop and implement conservation strategies for Biologically Unique Landscapes that truncate Nebraska state lines.

Increase Environmental Education

Education is an essential part of conservation. For the Nebraska Natural Legacy Project to succeed, Nebraskans need to be knowledgeable about the state's rich biological diversity and the stresses that threaten its existence. An environmentally literate citizenry is critically important to sustaining natural environments and making ecologically responsible choices regarding built or otherwise altered locations. When presented in an unbiased and scientifically accurate manner, environmental education (EE) is an essential tool that empowers learners of all ages to rise to the challenge of making sound decisions. People who become engaged in the natural world are more likely to appreciate the conservation of biological diversity and ecological integrity.

Topics relating to Nebraska's natural environment provide numerous opportunities for student learning. Most children have an innate interest in the natural world, yet time constraints, transportation issues, inadequate teacher training, lack of materials, curriculum requirements, and other factors are barriers to teachers wishing to deliver environmental education. The interdisciplinary nature of environmental education makes it appropriate for many subject areas, yet EE is mainly used in science disciplines. Although the 2003 Nebraska Conservation and Environment Literacy Survey indicated that 98% of Nebraskans support the teaching of environmental education in classrooms, most school districts provide only token support. Effective programs should show how such education can benefit students in core disciplinary areas and how it can help educators reach key standards.

The motto "Nebraska - The Good Life" underscores the importance of a healthy and sustainable environment to the well-being of the state's residents. The increasing urbanization of Nebraska, reliance on technology, and competing interests for unscheduled time is changing people's level of attachment and perceived reliance on the environment. It's critically important that both urban and rural Nebraskans maintain or establish a sense of place whereby they value, understand, interact with, and appreciate the local environment in which they live. Achieving a sense of place is contingent upon Nebraskans of all ages

having easy access to materials, trained educators, and opportunities to be immersed in the natural environment.

An environmentally literate citizenry has extensive social, ecological, and economic implications. The important role of education in furthering biological diversity conservation is becoming better understood and more widely accepted. According to the 2004 NASIS survey, 94% of Nebraskans feel that increasing education programs is very or moderately important to reverse the decline of “at-risk” species. Putting more resources into education can produce long-term societal benefits and help ensure continued and expanded support for the actions necessary to conserve biological diversity.

Actions Needed to Increase Environmental Education:

1. Work with universities and colleges across the state to ensure pre-service teachers are prepared with adequate science, ecological, and nature education knowledge before graduating. This could be accomplished by adding environmental education-specific courses or encouraging mentorships with current classroom educators already incorporating environmental education into their curriculum.
2. Provide quality training and support to formal and non-formal educators to increase capacity for environmental education. Examples of training opportunities include advanced ecoregion or ecosystem-specific workshops dealing with local flora and fauna and creation of workshops and resources specific to the Nebraska Natural Legacy Project (e.g., at-risk species information).
3. Support existing and develop new programs/partnerships/materials to improve learning opportunities to all age and ability levels (early childhood, school-aged students, adults) that will increase awareness, knowledge, appreciation, and shared responsibility of Nebraska’s biological diversity. Examples include but are not limited to Nebraska-specific curricula, activity guides, workshops/programs, educational trunks, portable classroom/laboratory, field trips, distance learning opportunities, websites, videos, posters, etc.
4. In collaboration with the state Department of Education, seek to address important issues related to biological diversity in state education content standards; specifically, but not limited to, state science standards. Additionally, work with the Nebraska Department of Education to adopt and incorporate the Nebraska Environmental Literacy Plan. This plan seeks to develop environmentally literate students and ensure that all students, by the time they graduate high school, are knowledgeable about Nebraska’s natural resources and environmental issues and willing to act on this knowledge to help conserve our natural legacy and solve our environmental problems.
5. Increase opportunities for students and adults to experience and learn about Nebraska’s natural communities by improving access to and organizing events such as tours, volunteer workdays, environmental festivals, field trips, etc. oriented around these natural communities. Promote the stewardship and widespread participation in

- outdoor activities, leading our citizenry to find and appreciate new values for the natural world.
6. Support individuals and groups that can address obstacles related to increasing Nebraskans' awareness, knowledge, and commitment to conserve biological diversity. Examples of individuals or groups include leaders from private and public conservation groups, educational institutions, formal and non-formal educators, community leaders, private landowners and others.
 7. Support existing programs that promote the development of natural communities (e.g., prairies, wetlands, native woodlands) at schools, parks, government offices, housing developments, businesses, etc. that can be used by the public to learn about biological diversity.
 8. Raise awareness about the role of farming, ranching and urban/suburban backyards in biological diversity conservation. Develop mentoring programs for landowners regarding ecologically-sound farming and ranching practices. Create neighbor networks where landowners can share information and help each other with projects.
 9. Work with partners, such as Cooperative Extension, to develop and conduct workshops for landowners, producers, community leaders, conservation practitioners, educators and others on topics such as prairie conservation, at-risk species management, invasive control, forest management, aquatic resources, available cost-share programs for projects, etc. Workshops should be offered at diverse times and seasons to accommodate various schedules including evening, weekends, and workdays.
 10. Use multiple media outlets (e.g., television/radio, print advertisements, internet, billboards, public displays) to increase awareness and support for Nebraska's biological diversity and inform the public of progress made to conserve species and habitats.
 11. Host workshops for non-formal environmental educators to help them understand the state education standards and how their programs can connect to these standards.
 12. Work with school administrators to see environmental education as critical to the development of well-rounded, knowledgeable students and citizens. Involve school administrators on nature or environmentally-related field trips.
 13. Provide an incentive-based program to encourage teachers to incorporate EE into their curriculums. Incentives could include: giveaways, free passes, travel scholarships (for educators to attend workshops/conferences or for classrooms to attend a field trip), or grants to help incorporate new EE resources.

14. Further train and develop a volunteer network of educators to facilitate enhanced quality programming in our state parks, nature centers, and through our diverse partner organizations, utilizing programs such as Nebraska Master Naturalist, Hunter Education, Boater Education, Aquatic Education, Project WILD, and Flying WILD.
15. Have high school and/or college students with an environmental-conservation background (e.g., a student conservation association) teach Natural Legacy classes/programs for experience and/or a stipend.
16. Organize or support scholarship programs for students who demonstrate a commitment to environmental conservation and pursue conservation-related trainings and degrees.
17. Initiate education efforts relating to reduction of global climate change and its potential effects on Nebraska's environment and wildlife.

Improve Conservation Programs and Incentives

Most conservation practitioners and many private landowners can attest to the large number and complexity of conservation programs. Landowners with an interest in conservation often have to wade through a sea of paperwork and long lists of options in order to enroll in programs or initiatives. It's often difficult for conservation practitioners to keep abreast of the many program offerings and it can be overwhelming for landowners who are interested in conservation but also want to make the best business decision. Although varying organizational missions and policies will likely always necessitate that there be multiple programs, better collaboration on the part of agencies implementing existing or developing new programs is needed to make conservation more "landowner-friendly."

The demand for technical and financial incentives by landowners to do conservation work is growing and is outpacing our ability to meet demand. Current resources need to be increased or made more efficient to meet the growing demand for landowner assistance. Some landowners simply need technical guidance provided from a best management practice guide and others need direct assistance through one-on-one consultation by a wildlife biologist. Many landowners also need financial incentives such as cost-share for doing habitat improvements, infrastructure to change management, or direct payments to set aside habitat or to enroll in conservation easements. Delivery of technical and financial assistance can include local (e.g., Natural Resource Districts), state (e.g., Nebraska Game and Parks Commission, Nebraska Forest Service), federal (e.g., Natural Resources Conservation Service, US Fish and Wildlife Service) agencies or private organizations (e.g., Pheasants Forever, The Nature Conservancy, National Wild Turkey Federation, Ducks Unlimited).

To be effective, biologists providing technical assistance must have a familiarity and understanding of conservation programs and knowledge of habitat requirements of species. Although no two conservation practitioners are likely to give identical advice to a landowner, it's important that management recommendations be based on the best available science. Landowners often become frustrated and lose confidence in organizations and agencies when resource professionals fail to communicate and give conflicting or contrasting advice. In

many cases, inconsistencies between related conservation programs result from a lack of communication within the conservation community. In other cases, agency missions differ and program rules reflect those differences. Policy differences (e.g., where to site tree plantings) between agencies can lead to confusion by the public and conflict between resource professionals. When possible, conservation agencies and organizations should strive for consistent policies to maximize biological diversity conservation throughout the state.

Conservation programs and financial incentives need to be voluntary, uncomplicated, flexible, and make economic sense in order for them to meet the test as “landowner-friendly.” Private landowners may feel that too much of their decision-making authority or income potential is surrendered in order to participate in conservation programs. In addition, some programs are overly rigid and don’t allow for changing conditions or the use of adaptive management practices. Although limited funding will often not allow conservation program payments to meet or surpass the income potential of intensive land uses such as cropping, it can provide an economic cushion when transitioning to management systems that may be more economically sustainable (e.g., changing from season-long to rotational grazing). Many landowners are willing to incur some loss in income if necessary to improve overall landscape condition, increase wildlife populations, and develop recreational opportunities.

Local economics play a significant role in conservation program participation. This includes property taxes which are a significant barrier to conservation program participation. One issue is that changes in land use or policies that result in lower property taxes are often not desirable because the revenues available for schools and roads are reduced. Another issue is that many landowners, including recreational landowners, typically need their property to generate at least sufficient income to pay property taxes. This leads many landowners to seek management alternatives that provide fewer benefits for “at-risk” species. Additionally, in recent years, the value of high quality wildlife recreation lands has risen at a higher rate than other lands, causing property values and associated property taxes to increase on working lands.

Actions Needed to Improve Conservation Programs and Incentives:

1. Seek private landowner and multi-organizational input when developing conservation incentive programs to 1) help ensure they are landowner-friendly (voluntary, incentive-based, adaptable, economically feasible, confidential, etc.), 2) support the missions of a broad array of conservation organizations, and 3) effectively conserve biological diversity. When possible, model new programs after successful programs used elsewhere and keep overall process relatively simplified.
2. Assess the barriers (e.g., permit processes) to landowner participation in conservation programs and use that information to improve existing programs and in developing new programs.

3. Explore opportunities to provide private landowners with incentives/income for assisting with restoration projects (e.g., native seed harvest), engaging in activities that support biological diversity (e.g., providing nature-based recreation opportunities, marketing of biological diversity-sustainable products), or being willing to tolerate wildlife-associated economic losses.
4. Seek opportunities to increase the focus of existing conservation programs (e.g., Wild Nebraska, EQIP) and funding sources to better conserve biological diversity and natural communities.
5. Develop a best management practice handbook to assist private and public landowners and land managers in the best methods to restore and manage natural communities.
6. Explore new funding sources that provide sustainable and equitable compensation for landowners who participate in programs that conserve biological diversity. Regularly adjust incentive rates to reflect changing economic conditions.
7. Seek to increase the capacity of agencies and organizations to provide efficient and high quality technical assistance to private landowners who are interested in conserving biological diversity.
8. When possible, seek to safeguard the local tax base by providing equitable compensation (e.g., payment in lieu of taxes) when conservation projects result in a significant reduction in property taxes.
9. Consider local economic impacts of conservation projects. Consider costs and benefits of actions to meet conservation goals, including needs for further conservation actions when goals have been met.
10. Seek out and promote innovative solutions to economic constraints on landowners interested in conserving biological diversity. These could include but are not limited to tax deferments, capital gains tax relief, and conservation buyer programs.
11. Develop and promote voluntary projects/programs aimed at conserving threatened and endangered species on private land and provide assurances to participating landowners that no additional future regulatory restrictions will be imposed (e.g., Safe Harbor Agreements).
12. Develop partnerships with community planning leaders, business leaders, and private organizations to develop best management practices (e.g., cluster housing) that can help ensure residential and commercial developments minimize the impacts to natural communities and biological diversity.

13. Collaborate with the Department of Natural Resources and Natural Resource Districts to discuss the impacts of watershed planning decisions made under LB 962 on fish, wildlife, and related resources in those watersheds. Undertake a watershed-by-watershed assessment of the impacts of changing streamflow conditions on biological diversity, starting with the watersheds under the most threat from increased water use.

Facilitate Species and Ecosystem Adaptation to Climate Change

Climate is one of the primary factors influencing species distribution and abundance. Thus, climate change is likely influencing species and ecosystems by altering fundamental interactions with other species and the physical environment, which could lead to a cascade of impacts throughout ecosystems. Many in the conservation community believe that climate change will be the greatest challenge to conserving biological diversity in the coming decades.

Climate change is already having a significant impact on species and documented effects include: shifts in species distributions, changes in phenology of species, and de-coupling of co-evolved interactions. In addition, climate change is expected to alter ecological processes such as fire pattern and hydrology and exacerbate a number of non-climate stressors such as habitat loss and fragmentation, pollution, and the spread of invasive species, pests, and pathogens.

One way that species have responded to climate change since the last ice age has been to shift their distribution to higher elevations or latitudes. Similar range shifts have already been documented and are expected to continue and increase in the future. However, two aspects of the current climate change may make this response problematic. There is currently significant habitat fragmentation and barriers to long distance movement and the rate of climate change is expected to be greater than in the past. In addition, during past climate change, species-level shifts in range and abundance were species-specific, with species migrating at different rates on different routes, and not as intact natural communities. Thus, we are likely to see natural communities disaggregating, depending on intrinsic response rates, and reconfiguring in potentially novel combinations, upslope or further north.

Phenology refers to the timing of annual life-cycle events such as the seasonal timing of flowering or migration. Many species operate on seasonal cues that are directly related to climate, so changes in climate may lead to changes in phenology of some species. The onset of spring, as measured by a variety of natural phenomena, has been occurring earlier since 1900, which in turn has led to shifts in the phenology of breeding, hibernation, migration, pollination, and productivity of some species. Studies have documented changes in timing of flowering, migration, insect emergence, and peak biomass. Climate change will influence both plant and animal phenology, potentially disrupting crucial interactions that influenced species persistence as well as how ecosystems function and what services they provide.

Species are not expected to respond uniformly to climate change but will respond individually with changes in distribution and/or phenology. Thus, there is likely to be a de-coupling of ecological relationships among species as they respond to climate change in different ways at different rates. For example, the timing of emergence of an insect

pollinator may shift and become out of synch with the flowering time of its host plant. This de-coupling may lead to local extirpations and have significant impacts on ecosystem structure and function. This may be one of the greatest impacts facing many wildlife species, which, given their mobility, are otherwise able to adapt to climate change by shifting their ranges.

Potential climate change effects on fire, hydrology, habitat fragmentation, pollution, and invasive species are discussed in subsequent sections of this chapter. Tier I at-risk species have been evaluated for their vulnerability to climate change and that information is found in Appendix 8. For additional information on potential impacts of climate change on species and ecosystems, and possible conservation strategies, see the further reading section at the end of the references.

Given the uncertainty in the magnitude, rate, and nature of future climate change, uncertainties about how climate change will interact with other species/ecosystem stressors and the limited understanding of how species and ecosystems will respond to the changes, the initial focus of the Natural Legacy Project will be on “no regrets” adaptation strategies. These are strategies that will provide net conservation benefits regardless of climate change. In addition, since it is difficult to make detailed recommendations given the above uncertainties, the initial adaptation strategies listed here are fairly broad. As climate predictions become more refined and knowledge of biotic responses to climate change increase, more specific strategies can be developed.

Climate Change Adaptation Strategies:

1. Reduce the impacts of non-climate stressors

Because of the interconnectedness of climate and natural systems, climate change is expected to affect other system stressors such as invasive species, pests, pathogens, pollution, and habitat loss, degradation, and fragmentation. These stressors may be exacerbated by climate change and/or the stressors may limit the ability of the species or ecosystem to cope with climate change. Addressing existing stressors is one of the most valuable and least risky strategies, in part because of the large existing body of knowledge about their impacts and solutions.

2. Restore and maintain ecological processes and ecosystem function

Natural systems are dependent on a variety of ecological processes including disturbance and hydrologic regimes (e.g., fire, flooding, etc), energy and nutrient flows, and species dispersal. Past human alteration of these ecological processes has been a stressor on natural systems. Restoration and maintenance of these processes can increase the resilience of systems to climate change. Restoring and maintaining biological diversity can also increase the ecological resilience of ecosystems, and thus increase their adaptive capacity in the face of climate change.

3. Protect and maintain a network of conservation areas

This strategy would increase the extent of terrestrial and aquatic habitats that are protected from non-climate threats. The strategy could also be used to protect movement corridors or stepping stones to allow for species dispersal in response to climate change.

4. Restore and maintain habitat and landscape connectivity

Managing species and their habitats in the context of climate change will require an increased emphasis on connectivity to enable species to move into locations with appropriate climatic conditions. Maintaining habitat connectivity at the scale needed for climate change adaptation will require strategic planning and investment and meaningful collaboration among public and private parties.

5. Increase knowledge about climate change impacts and species and ecosystem responses

There is a great deal of uncertainty regarding future climate change and the impacts to and responses of species and ecosystems. We need to increase our understanding of these impacts and responses in order to develop and implement more effective conservation strategies. Means of filling these knowledge gaps include vulnerability assessments, monitoring, experiments, and modeling.

6. Utilize an adaptive management approach in implementing adaptation strategies

Any strategy for managing the effects of climate change on species and ecosystems should be deployed within an adaptive management framework to enable managers to learn from previous management activities and to respond quickly and creatively to the challenges posed by climate change.

Promote Management that is more Compatible with Conserving Biological Diversity

Nebraska's 48,000 farms and ranches cover nearly 46 million acres (93% of the total land area), making landowners the primary stewards of Nebraska's biological diversity. Activities on these lands directly impact individual species, natural communities, and larger ecosystem processes (e.g., hydrology, stream quality, nutrient cycling). According to the 2004 NASIS survey, over 90% of Nebraskans felt that farmers and ranchers should have a major or moderate role in conserving "at-risk" species in the state. In order to meet this public expectation, the state's farmers, ranchers, and conservation organizations will need to collaborate and share responsibility for the conservation of biological diversity.

Nebraska has nearly 1,600 square miles of public conservation lands. These existing protected areas (e.g., national wildlife refuges, national forests, national monuments, state parks, wildlife management areas) are critical to the conservation of biological diversity. However, past management approaches have not always taken into consideration the needs of the greatest array of species. For example, more public lands could be enhanced for wildlife, using prescribed burns and grazing appropriate to local plant communities. Public perception reflects these sentiments. According to the 2004 NASIS survey, 90% of Nebraskans feel that improving management on existing public lands is very or moderately

important to reversing the decline of at-risk species. In order to more fully conserve biological diversity on public lands, increased resources, training, support, and encouragement will be needed.

Maintenance of biological diversity will require that conservation efforts be directed at a broad range of land use issues and management practices on both private and public lands. In the past, management actions on public and private lands have been directed disproportionately at a relatively small subset of species (e.g., game species, threatened and endangered species) and inadequately at conserving intact natural communities. There is a need to broaden the focus of management and seek to implement strategies that benefit a broader array of Nebraska's biological diversity.

Nebraska's urban and rural citizens need to share responsibility for our culture's impacts on biological diversity and play a role in future conservation efforts. Biological diversity cannot be conserved solely on public lands or solely on private lands. Instead, conservation efforts will need to combine improved management on existing public lands, by protecting some additional lands through acquisition and conservation easements, and by implementing voluntary and incentive-based conservation actions on private lands.

In the last two centuries, land use and land management practices have significantly altered Nebraska's biological landscape and the ecological processes that sustain the flora and fauna of the state. Historically, the primary forces that shaped the pattern of plants and animals on our landscape have been climate (e.g., droughts, floods), fire, and grazing. Today, additional factors such as artificial changes to hydrology, competition and predation from invasive species, habitat fragmentation, pollution, and climate change directly impact species and alter ecological processes, leading to degradation of habitat. Conservation practitioners identified six key stresses that are impacting biological diversity in Nebraska: 1) altered fire frequency, 2) altered grazing strategies, 3) altered hydrology, 4) introduction of invasive species and pathogens, 5) habitat fragmentation, and 6) pollution. The stressors will interact with climate change and may be exacerbated by it and/or the stressors may limit the ability of species or ecosystems to cope with climate change. Climate change and its potential effects on biodiversity should also be considered as management plans are developed.

Fire Management Systems

Historically, fire was a natural disturbance to Nebraska's ecosystems, serving as an important influence on biological diversity. Prior to European settlement, fires likely occurred on a 1-5 year interval in eastern Nebraska and a 10-20 year interval in western Nebraska. Suppression of fire is one of the primary factors that alter Nebraska's natural communities. Today, less than one percent of the state's grasslands and woodlands are likely burned in any given year. The Loess Hills region of the mixed-grass prairie of Nebraska is a prime example of the problems associated with fire suppression. The rapid expansion of eastern red-cedar trees across this region has degraded and fragmented natural communities and is leading to declines in native species and reduced livestock forage. Fire serves an important role in prairie maintenance by promoting nutrient cycling, creating microhabitats, and increasing plant vigor and native plant diversity. Fire leads to similar benefits in woodland communities. Though some areas with dense tree cover may require mechanical thinning prior to burning in order to reduce fuel loads and prevent stand-replacement fires. There is

also an important but poorly understood interaction between fire and grazing. In the past, burned areas often received intense grazing from bison or other herbivores following fire. This combination is rarely applied in today's landscape.

Models project that climate change will result in an increase in fire frequency, particularly in the western U.S. The length of the fire season has increased over the past three decades and the amount of area burned in the west has increased six-fold in the last twenty years. In Nebraska, an increase in fire frequency would likely have the largest impact in the Pine Ridge and Wildcat Hills, where decades of fire suppression have resulted in heavy fuel loads. Historically, wildfires in those areas were low intensity, ground fires burning through open pine woodlands. With current conditions, wildfires would likely be high-intensity crown fires which may have a more negative impact on the habitat. For the grassland habitats in the state, fire suppression efforts have kept fire frequency at levels far below what was experienced historically, and an increase in fire frequency would likely be beneficial to those systems.

A growing number of individuals are becoming interested in using fire to control woody plant invasion or revitalize grasslands. Many landowners don't have the capacity (e.g., equipment, burn crews) or expertise to use fire safely. Conservation practitioners often lack the resources to carry out the desired level of burning on private or public lands, and few private contractors are willing to burn because of liability concerns. Several cooperative efforts are underway to increase interest in prescribed fire. The Prescribed Burn Task Force and Great Plains Fire Learning Network hold workshops and demonstration burns for private landowners in order to promote prescription burning.

Actions Related to Fire:

1. Promote the safe use of prescribed fire as a tool for grassland/wetland/forest restoration and management through public outreach and internal communication among conservation organizations and agencies. Conduct demonstration burns as a means to facilitate understanding and acceptance of burning.
2. Increase the capacity of private landowners to burn by providing technical and financial assistance, equipment, fire-training workshops, how-to guides and other assistance.
3. Identify and seek to overcome barriers that limit the ability of managers and private individuals to conduct prescribed burning on private and public lands.
4. Develop and distribute a "best management practices guide" on prescribed burning that can be used to improve management of grasslands, woodlands, and riparian areas for biological diversity. Include information on sources of technical information, funding programs, equipment needed, etc.

5. For select grasslands, evaluate the use of patch-burn grazing and other grazing systems that combine the interaction of fire and grazing to mimic pre-settlement disturbances. Timing, intensity, and duration of any fire-grazing system need to be carefully planned and implemented. Biologists and ranchers should carefully coordinate management strategies.
6. Consult with species experts and perform pre-burn evaluations to minimize impacts to species that may lack the ability to re-colonize a site following burning.
7. Assist prescription burning efforts through education, training, and participation to promote and support the establishment of burn cooperatives made up of local landowners, agencies and partners.
8. Provide training and support to landowners and others to conduct rapid pre/post burn monitoring and assessment.
9. For woodland and forest systems, particularly in western Nebraska, use mechanical tree-thinning and prescribed fire to increase the resiliency of the system to wildfires.

Grazing Management Systems

Nebraska contains approximately 22 million acres of rangeland and pastureland. Most grassland-associated plant species have evolved with and are maintained by grazing, so ensuring that the existing 22 million acres are sustained for cattle grazing is important for biodiversity. Grazing is a conservation tool that can promote structural heterogeneity, native plant diversity, and can help control invasive species, depending on application. Managing both the timing and intensity of grazing is important to achieving plant health and diversity and maximizing benefits to the widest variety of species. Grazing can be applied in a manner that is mutually beneficial to the goals of biodiversity conservation and cattle production.

Historically, grazing patterns were likely driven by fire frequency and weather. Today, most grazing takes place in the absence of fire and with relatively little variation in timing and intensity. As a result, large areas of prairie have shifted from diverse mixes of native grasses and forbs to grasslands dominated by a relatively small number of grasses (often non-native species such as Kentucky bluegrass and smooth brome) and less palatable early successional forbs such as western ragweed, snow-on-the-mountain, soapweed and musk thistle. This conversion has taken place after years of season-long grazing and has been intensified by broadcast applications of herbicide and inter-seeding of non-native grasses. Restoration of these sites is often very difficult even if a more diversity-friendly grazing system is introduced.

Both overgrazing and a lack of grazing can be detrimental to biological diversity. Overgrazing can severely impact the composition of grasslands, favoring species rarely grazed by cattle and adapted to consistent grazing pressure. Overgrazing near streams and wetlands can increase the amount of sediment and other pollutants entering water bodies. Conversely in the absence of fire, the lack of grazing can lead to a loss in plant diversity because of thatch accumulation, competition by non-native species, and loss of microhabitats

necessary for propagation of some species. A lack of grazing on wetlands can favor the establishment of monotypic stands of robust emergent plants.

Haying and mowing can serve as alternatives to grazing and provide benefits to species and habitats. Haying and mowing can be particularly effective at controlling woody encroachment and removing thatch but lack some benefits of grazing such as selective herbivory, soil disturbance from hoof action, and nutrient cycling through animal waste. Under homogenous haying or mowing practices, plant composition and habitat structure often decline and natural re-seeding can be inhibited.

Actions Related to Grazing/Haying:

1. Promote and support the use of diverse grazing/haying systems on private and public lands that enhance biological diversity and sustain natural communities. Initiate research that evaluates the effectiveness and profitability of biological diversity-friendly grazing/haying systems (e.g., reduced stocking rates, rotational systems).
2. Develop and distribute a “best management practices” guide on grazing that can be used to improve management of grasslands and riparian areas for biological diversity. Include information on sources of technical information, funding programs, wildlife-friendly fencing specifications, etc.
3. Promote and support the development of locally-based grazing cooperatives and incentive programs that can be used to facilitate grazing of playa wetlands, small disjunct prairie sites, woodlands and other sites with low grazing income potential.
4. Support diverse haying strategies (e.g., on wet meadows) that stagger timing and height of cutting, promote increased plant and animal diversity, and avoid peak nesting periods for grassland birds.
5. Promote the use and availability of locally adapted native seed sources for pasture and rangeland seedings.
6. Promote livestock grazing/haying systems that have built-in drought management contingencies (e.g., grass banking).
7. Seek and promote economic alternatives that help reduce further conversion of important rangelands and pastures to cropland.

Altered Hydrology

Historically, Nebraska had approximately 3 million acres of wetlands and nearly 24,000 miles of rivers and streams. Today, approximately 35% of the state’s wetlands have been lost including nearly 90% of some playas, saline wetlands, and wet meadows. Although most of the state’s rivers and streams have been significantly modified from reductions in flows and through channelization, the Sandhills ecoregion stands out as containing some of the most unaltered rivers and streams remaining in the Great Plains. Continued conservation of the state’s wetlands, rivers, and streams are critically important to sustaining biological

diversity. Nearly half of Nebraska's Tier I at-risk species are dependent upon wetland or riverine habitats.

Approximately one million acres of wetlands have been lost in Nebraska, principally through drainage for agricultural development. The loss and alteration of wetlands has reduced habitat for many resident and migratory species and has resulted in severe overcrowding for spring migrating waterbirds. The lack of management or disturbance of existing wetlands has led to the spread of invasive species and the usurping of wetlands by a few dominant plants, resulting in a decline in natural biological diversity. Although past governmental programs facilitated wetland drainage, a shift in public attitudes in the 1970's and 1980's has resulted in increased interest by agencies, communities and private landowners to understand and conserve wetlands.

There have been substantial changes to Nebraska's rivers during the last two centuries. Nebraska's largest rivers historically experienced large fluctuations in flows, particularly in the spring when snow melt and spring rains scoured sandbars and moved sediment, creating treeless expanses favored by migratory birds and other species. Direct diversion of surface flows and pumping from alluvial wells for irrigation and municipal water supplies has substantially reduced stream flows in many rivers, caused others to dry up completely, and impacted native aquatic and terrestrial communities.

Although, droughts are a natural phenomenon in the Great Plains, conflicts over water use are intensified during extended dry periods. Healthy wildlife and plant communities are well adapted to withstanding long periods of drought, but biological diversity is threatened as rivers and streams reach or exceed full appropriations. Diversion of water from streams and rivers during drought can greatly reduce the amount of deep-water refugia available to fish and raises water temperatures that can result in fish and invertebrate mortality. Pumping of groundwater for irrigation, municipal and other uses lowers water table levels that would otherwise sustain grassland plants through hot and dry periods. Dams and other barriers on rivers and streams restrict fish and wildlife movements, leaving large expanses of potential habitat uninhabited and/or suppressing gene flow among populations.

Climate change may significantly alter the hydrology of wetlands, rivers, and stream in the state. Projections are for increases in the intensity of periodic droughts, increases in evapo-transpiration loss from rising temperatures, and increases in the frequency of heavy precipitation events, leading to more frequent and intense flooding. Predictions for the Rocky Mountains are for an increased proportion of winter precipitation to come as rain, thus reducing the overall snowpack. In addition, the earlier onset of spring will result in earlier melting of snowpack. Both of these trends have been observed in recent decades. These changes will impact the timing and amount of Platte River flows, and the species and habitats that depend on them, particularly in late summer.

As public awareness of the value of wetlands and natural flowing rivers has changed, efforts to restore these important habitats on both private and public lands have increased. Across the state, hundreds of wetlands have been voluntarily restored and countless other restoration projects are planned in the future. The ability of landowners to use wetlands for grazing and

hay production after restoration helps meet landowner needs for income and maintains some level of disturbance that promotes wetland health.

The conservation of Nebraska's streams, rivers, and their associated aquatic habitats will require hard work, compromise, and a shared vision for conserving Nebraska's biological diversity and sustaining an agricultural economy. Much is to be gained by conserving both, but change will be necessary. It is recognized that in some instances in the state, irrigation may augment habitat. Pools of water are generated in areas that would otherwise be dry. These water sources can be useful to wildlife. Innovative solutions are required to ensure there is enough water to meet the needs of people and wildlife and that effective measures are taken to maintain water quality.

Actions Related to Hydrology:

1. Seek to maintain or restore the natural hydrology of rivers, streams, and wetlands to sustain biological diversity and ecosystem function. Accomplish this through the use of voluntary incentives, sound bio-engineering solutions, and through collaborative decision-making.
2. Establish an interdisciplinary working group that can develop a shared vision for the judicious use of limited water resources by developing drought mitigation strategies, alternative cropping/irrigation methods, etc. that conserve and enhance biological diversity and lead to increased economic sustainability.
3. Assess where current stream flows are inadequate and flow appropriations would most effectively contribute to the maintenance of biological diversity in Nebraska.
4. Promote the development of an integrated water management plan for all water uses throughout the state.
5. Promote and provide incentives for the use of wildlife-friendly conservation buffers, grassed waterways, sediment traps etc. on lands adjacent to wetlands, rivers, streams, reservoirs, and lakes to prevent siltation and protect water quality.
6. Strengthen existing or establish new statewide partnerships responsible for promoting wetland, river, and stream conservation.
7. Promote the value of naturally meandering rivers and streams, role of floodplains as habitat, and the need to maintain or closely simulate the natural hydrograph of rivers and streams to benefit biological diversity.
8. Evaluate the impacts of new dams, additional groundwater and surface water withdrawals, channelization, and levy/dike construction on biological diversity.
9. Promote the development and use of water conservation measures such as more water-efficient irrigation systems, xeriscape landscaping, water-conserving appliances, etc.

Introduction of Invasive Species and Pathogens

Most natural communities in Nebraska have been impacted by invasive species, in most cases by plants that were deliberately or accidentally introduced by people. Many naturalized species such as common dandelion and ring-necked pheasant appear to have little impact; whereas, others significantly affect biological diversity. Aggressive exotic species negatively impact native species through competition, direct predation, disruption of food chains, or by altering habitat or ecological processes. Nationally, invasive species are considered the second leading threat to biological diversity, second only to direct habitat loss. According to the 2004 NASIS survey, 58% of Nebraskans feel that non-native species are very or moderately likely to threaten at-risk species in the state and another 21% didn't know if exotics had a significant impact.

Most of Nebraska's native grasslands include a mix of native and non-native species. Exotic grasses such as smooth brome, Kentucky bluegrass, and cheatgrass are aggressive and often increase under season-long grazing or when there is soil disturbance. Invasive forbs such as musk thistle, leafy spurge, and sericea lespedeza impact both natural communities and grazing lands, resulting in impacts to biological diversity and the grazing industry. The control of noxious weeds often results in unintentional impacts to native plants.

Invasive plants such as reed canary grass, common reed, and purple loosestrife are threatening many of Nebraska's wetlands. Other species such as Canada thistle and Russian/Autumn olive, and Eurasian water-milfoil, have impacted many of the state's wetlands. Introduced species significantly reduce plant diversity and animal use of wetlands. Some species such as saltcedar may impact the hydrology of wetlands and rivers by increasing water consumption. Nebraska's forests are threatened by garlic mustard and other plants that competitively exclude native species.

Many introduced animal species directly threaten biological diversity. The western mosquitofish competes with and often excludes the native plains topminnow. Common carp can alter bottom substrates and impact water quality and silver carp can disrupt food chains. House sparrows and European starlings compete with native cavity nesting birds for nest sites. The zebra mussel may threaten the state's native mollusks. And at several locations in the state, feral hogs have become established. The impacts of introduced species that are important for recreation such as Rainbow trout, bullfrogs, and red fox are not well known but need to be assessed.

Less is known about the impact of pathogens on wildlife in Nebraska. Diseases such as avian cholera have resulted in large die-offs of waterfowl during spring migration. West Nile virus has been documented to cause mortality in more than 150 species, including humans, but its impact on overall biological diversity is unknown. Blue tongue can result in severe mortality and chronic wasting disease could potentially have a devastating effect on native ungulates. More resources need to be dedicated to understanding the impacts of diseases and other pathogens on biological diversity, and proactive solutions need to be identified and implemented.

Climate change is expected to interact with other environmental variables to affect the abundance, distribution, spread, and impact of invasive species, pests, and pathogens. Along with native species shifting their ranges, invasive species and pathogens are expected to expand their ranges into newly suitable environments. Invasive species often have good dispersal abilities and will be able to take advantage of newly suitable habitats. These invasive species, pests, and pathogens will cause stresses on native species that are struggling to cope with a changing climate.

Actions Needed to Reduce the Impacts of Invasive Species and Pathogens:

1. Support existing cooperatives, such as the Nebraska Invasive Species Project, with the intent to organize a diverse network of agencies and organizations to gather and share information about invasive species, new control measures, control efforts that are underway, distribution of invasive species, and funding issues. Collaboratively develop and widely distribute a list of all known invasive species that threaten the state's biological diversity and develop best management practices that can be used to control or reduce the spread of those species.
2. Develop and implement early detection and rapid response programs for invasive species, pests, and pathogens.
3. Use and promote restoration and management techniques that utilize native, locally-adapted species whenever possible. Discourage the use of non-native species in restoration/management projects.
4. Encourage private seed companies to provide local-ecotype seed and harvesting and planting services.
5. Renovate aquatic habitats by removing introduced rough fish to improve water quality, enhance aquatic vegetation and increase biological diversity.
6. Seek measures that prevent the introduction, breeding, and use of potentially invasive non-native species by nurseries, hatcheries, universities, etc.
7. Develop and distribute best management practices and educational materials to reduce the inadvertent transport of invasive species, pests, and pathogens.
8. Collaborate with natural resource organizations and others to develop a list of preferred plant materials (e.g., trees, shrubs, grasses, forbs) that can be used in urban and rural settings with little threat to biological diversity. Develop guidelines that will help ensure potentially invasive species do not spread to natural communities.
9. Develop guidelines for the application of herbicides and use of biocontrols targeted at invasive species so that impacts to biological diversity are minimized.
10. Initiate a public outreach campaign on the impacts of invasive species on biological diversity.

11. Investigate the factors leading to the spread of invasive species, diseases, and other pathogens and their impacts on biological diversity. Track the spread of invasives and transmission of pathogens to better develop and implement proactive conservation actions.
12. Develop and implement protocols to better monitor, assess impacts, respond to, and manage disease stresses in Nebraska.
13. Develop proactive management actions to impending disease stresses (e.g., chronic wasting disease, West Nile virus) to help limit future impacts to biological diversity.
14. Assess possible risks of invasive species spread from commercialized wildlife operations and work with facility managers to take appropriate preventative measures.

Habitat Fragmentation

Any type of habitat can become fragmented when it is altered in a way that reduces its amount and quality for wildlife populations. Large-scale habitat fragmentation has occurred over most of the state with the exception of the Sandhills. Conversion of native habitats to crop fields, housing developments, and roads are the principal sources of fragmentation. Acreage development, particularly on native prairie sites, is resulting in accelerated loss and fragmentation of remaining grasslands. Infrastructure such as roads, dams, cell phone towers, wind energy turbines, and fences can impact species directly by altering movement or increasing mortality. Other forms of fragmentation can lead to the introduction or spread of invasive species or alteration of ecological processes such as predator-prey relationships. Habitat fragmentation has particular consequences for species that are relatively immobile, or area-sensitive species that require large intact landscapes.

Nebraska, the Arbor Day state, has a long and proud history of tree planting. Tens of millions of trees have been planted to provide shelter to livestock, as windbreaks for homes, for aesthetics and as wildlife habitat. However, the planting of trees in native grasslands can negatively impact grassland-dependent species and some invasive trees like eastern red-cedar can rapidly spread into adjacent habitats, fragmenting prairie landscapes.

Nebraska is ranked among the top ten states in the nation for wind energy potential. Wind energy is seen as a “green” energy source because during the operation of a wind energy facility, there are no emissions of greenhouse gases or other pollutants. In general, the conservation community supports the development of wind energy as it has the opportunity to provide a renewable form of energy that can enhance economic well-being for Nebraskans, and is a means of reducing climate change, which will have significant impacts on wildlife. However, no energy source has yet been found to be without some degree of environmental costs and wind energy is no exception. Proper placement of wind turbines and their associated power lines is essential to prevent further fragmentation of the landscape. For example, one should avoid siting turbines near wetlands, rivers, and/or riparian corridors as these are excellent habitats for many native species. For more detailed

siting recommendations, refer to the Wind Guidelines developed by the Nebraska Game and Parks Commission and its partners.

A prevalent response of species to climate change has been to shift their distribution ranges to find suitable conditions. Migration of species ranges is only feasible if suitable habitat is both available and accessible. However, for many species, habitat fragmentation has reduced their ability to shift their ranges. Managing species and their habitats in the context of climate change will require an increased emphasis on connectivity. Maintaining habitat connectivity at the scale needed for climate change adaptation will require strategic planning and investment and meaningful collaboration among public and private parties.

One approach to offset the impacts of habitat fragmentation and climate change to wildlife is to identify, restore, and conserve corridors for species movement. However, identifying corridors can be challenging. Studies of past species range shifts show that species do not move in a straight line and current modeling capability is not able to predict where suitable conditions for a particular species may be in the future. In addition, restoring and conserving a large scale corridor in a highly fragmented area like the tall-grass prairie ecoregion would be expensive and politically difficult. A more fruitful approach may be to research and implement strategies to make the working landscape matrix more permeable to species dispersal.

Actions Needed to Reduce Habitat Fragmentation:

1. Provide incentives to private landowners to maintain natural habitats and to cooperatively manage large blocks of habitat as complexes that conserve biological diversity.
2. Collaborate with planning commissions, county commissions, and building associations to site new housing units in a manner that reduces fragmentation of existing natural communities.
3. Seek to enlarge habitat complexes by restoring converted or degraded sites within larger landscapes of habitat. Create habitat corridors to connect disjunct tracts of habitat.
4. Discourage the placement of woody plantings and food plots within natural grassland communities, especially when it will result in increased fragmentation.
5. When possible, take into consideration potential impacts to biological diversity when selecting sites for cell phone towers, wind turbines, dams, fences and other semi-permanent structures. It is preferable to site facilities on previously altered landscapes, such as areas of extensive cultivation, near towns, or urban and industrial areas, while making the greatest possible use of existing access roads and utility corridors. See Nebraska Game and Parks Commission guidelines for wind energy development.

6. Collaborate with transportation planners (e.g., NE Dept. of Roads, Federal Highway Administration) to minimize impacts to at-risk species and their habitats.
7. Seek to remove or create bypass structures around dams and other impediments that restrict the natural movement of aquatic species.

Pollution

Water pollution is a principal stress to aquatic species and overall biological diversity. Water pollution includes both point and non-point sources and can include toxic chemicals, sediment, nutrients, minerals such as road salt, pesticides, and animal or human waste. Climate change projections are for an increase in the frequency of short duration/high intensity precipitation events, which will result in increased surface run-off and transport of pollutants to water bodies. Pollutants can result in direct mortality to species (e.g., fish kills from toxic chemicals) or can alter natural communities and ecosystem function (e.g., eutrophication resulting from phosphorus run-off). Bioaccumulation of toxic substances can impact entire food chains and reduce the recreational value of aquatic resources.

Nebraska has 1558 stream segments flowing over 16,000 miles and 528 lakes and reservoirs that cover more than 148,000 acres. For the 2010 Nebraska Water Monitoring Programs Integrated Report, the Nebraska Department of Environmental Quality conducted assessments on 413 stream segments and 225 lakes equating to more than 9,000 miles of streams and 138,000 lake acres being assessed. Of the 413 stream segments assessed, 221 were supporting their assigned uses, while 192 were impaired. Of the stream segments considered impaired, 63% were due to the presence of *E. coli*, 16% due to impaired biology, 10% due to fish consumption advisories, and 11% due to atrazine. Lake assessments found 123 lakes impaired and 102 supporting their assigned uses. Of the lakes considered impaired, 39% were due to nutrients, 28% due to fish consumption advisories, 19% due to pH, and 14% due to low dissolved oxygen.

Most Nebraskans recognize water pollution as an important threat to biological diversity. According to the 2004 NASIS survey, 92% of Nebraskans stated that water pollution is very likely or moderately likely to threaten at-risk species. In Nebraska, local Natural Resources Districts, the Nebraska Department of Environmental Quality, and the federal Environmental Protection Agency regulate water quality. These agencies and others help implement a number of voluntary best management practices to help prevent or mitigate sources of water pollution.

Actions Needed to Reduce the Impacts of Pollution:

1. Promote the practice of integrated pest management (e.g., non-chemical controls such as bio-control and tillage, spot spraying) through outreach and incentives to minimize impacts to biological diversity.
2. Facilitate information exchange between conservation practitioners, landowners, and the public regarding the sources and impacts of pollution on wildlife. Provide regulatory agencies (like NDEQ) with information on the impacts of pollution on biological diversity to help make better decisions.

3. Implement and seek funding for conservation practices such as filter strips, grassed waterways, sediment control basins, and grassed buffers to minimize the effects of fertilizers and pesticides on wetlands, streams, rivers and reservoirs.
4. Work with agricultural and conservation partners to prioritize installation of conservation buffers, conservation tillage practices, etc. within watersheds where benefits to biological diversity would be highest.
5. Promote management practices that limit the impacts of nutrients, sedimentation, bacteria and pesticides to help protect water quality. Examples include nutrient application on cropland, sediment control on construction sites, incentives for organic farming and low-chemical farming, etc.
6. Share information with agencies and stakeholders about the importance of biological diversity and the benefits of locating power plants, factories, animal feeding operations, homes and other potential sources of pollution in places that will have minimal impact on river, stream, and wetland water quality. When optimal siting is not feasible, state-of-the art waste containment facilities should be constructed.

Focus Conservation on the Best Opportunities

Conservation of Nebraska's biological diversity is an enormous undertaking and the human and financial resources needed to address this task remain limited, even with new federal funding. Conservation efforts in the past have been largely opportunistic and while important work has been done, it was not always the most efficient and effective use of limited resources. For example, using scarce funds to protect a lower quality tall-grass prairie with less biological diversity may preclude the protection of a higher quality prairie with more biological diversity. Given that habitat loss will continue, those higher quality prairies may be lost before an "opportunistic" approach would conserve them.

We need to improve the efficiency and effectiveness of conservation by taking a more systematic approach to identifying and prioritizing the components of biological diversity we wish to conserve and where in the state we should focus conservation efforts. Being more efficient and effective means implementing conservation actions that provide the best opportunities to maximize conservation of biological diversity, minimize resource conflicts, and avoid future stresses.

Whenever possible, agencies and organizations should pursue strategic rather than opportunistic approaches to biological diversity conservation. Multiple objectives can often be met by taking a habitat-based approach that benefits multiple species and habitats. Conservation efforts should be focused, when possible, on areas with multiple habitat types and opportunities to benefit at-risk species. They should also focus on those sites that offer the best opportunity for long-term success in sustaining species and ecological communities. For target species, these include sites at which the species' populations have a high estimated viability (large population size, appropriate age class, successful reproduction, and few threats). For ecological communities, these would include sites with a high percentage of expected native species, few invasive exotic species, and where ecological processes

essential to maintaining the community (e.g., fire, grazing, flooding) persist or can be simulated through management. Sites that have structural and functional complexity, high habitat quality, and close to their full complement of species are also likely to be more resistant and resilient to climate change.

In developing the Nebraska Natural Legacy Project, we utilized a systematic approach to identifying at-risk species, ecological communities, and biologically unique landscapes in the state (see chapter 3). This effort was based on the best available data and represents a first attempt to take a statewide, systematic and strategic approach to the conservation of biological diversity. Using an adaptive management strategy, we continue to adjust our wildlife conservation priorities and actions. We hope these efforts will prove useful in identifying conservation targets and focal areas in the state, making the best use of our limited resources.

Actions Needed to Focus Conservation on the Best Opportunities:

1. Conduct inventories to identify additional Biologically Unique Landscapes that contain high-quality examples of ecological communities and populations of at-risk species.
2. Continue inventory of the currently described Biologically Unique Landscapes to better identify areas within them where multiple conservation objectives can be met.
3. Provide information to conservation planners and practitioners to help focus conservation actions. Decision-support tools (e.g., GIS data, models) may be used to evaluate options.
4. Implement actions at those sites that offer the best opportunity for success in the long-term conservation of species and ecological communities.
5. Work to ensure that high-quality occurrences of all terrestrial and aquatic community types in Nebraska are under long-term protection and management.
6. Work to ensure that occurrences of viable populations of at-risk species are under long-term protection and management.
7. Monitor changing conditions and population fluctuations to better adapt management efforts as needed.

Maintain and Expand the Network of Public and Private Conservation Lands

The continued loss and degradation of natural habitats undermine efforts to conserve biological diversity in the state. Nebraska's ranches, farms and private and public conservation lands provide the foundation for a support system for the state's flora and fauna. Almost all existing habitat in Nebraska is under the stewardship of private landowners, and this will continue. Maintaining and improving existing habitat on working farms and ranches

is key to conserving biological diversity and offers the greatest hope for success. There is also a need for some lands to be put under long-term protection and managed specifically for biological diversity. A network of conservation lands is needed that includes a combination of protected working private lands and public and private conservation areas managed for the purpose of perpetuating biological diversity.

Habitat loss is the primary cause of species decline. Most of the state's natural communities, with the exception of those found in the Sandhills and a few other areas, have undergone extensive losses. Some, like the tall-grass prairie have been reduced to less than 2% of their original extent. While it is possible to restore cropland and other altered lands, reestablishing the full complement of biological diversity is often impractical and prohibitively expensive. To be able to conserve the full array of biological diversity, we need to conserve existing natural habitats that are still in relatively good condition. John Weaver the acclaimed prairie ecologist noted:

“Prairie is much more than land covered with grass. It is slowly evolved, highly complex, and centuries old. Once destroyed, it can never be replaced by man.”

An important way to ensure that species, habitats, and ecosystem processes are maintained over time is to devote some portion of the landscape to those specific purposes. This can be done by expanding the network of lands that have long-term protection from conversion/degradation and to manage these lands principally for biological diversity. This network of conservation lands does not have to be limited to those owned by government agencies or conservation organizations. Private lands with conservation easements, long term leases or management agreements could also be included. Length of conservation easements and long-term management should be carefully considered. Collaboration with private landowners adjacent to lands under long-term protection can enlarge or buffer these lands resulting in larger blocks of habitat. These lands do not need to be managed to the exclusion of human uses. The key lies in the emphasis on biological diversity values, not as a collateral or subsidiary benefit, but as a primary goal for managing the land.

Consideration of climate change can inform decisions when selecting sites for protection. Sites with greater habitat and topographic diversity will allow species to move locally to find suitable conditions as the climate changes. In addition, the more heterogeneous and complex a site, the more microhabitats are likely present that can meet requirements for a wide range of species. Selecting sites within intact landscapes will also facilitate species movement. A network of conservation areas should include representation of all habitat and community types as well as ample replication.

New approaches to land conservation that take into account the dynamic nature of climate change effects on species and ecosystems will likely be needed. One approach that is being discussed is to protect a network of conservation “stages,” nature reserves that capture the geophysical diversity (topography, soils, geology) of a region. Conserving a full spectrum of different geophysical settings, stratified across elevation zones and latitudes, may offer an approach to conservation that protects diversity under both current and future climates. Instead of aiming to maintain a particular species composition, the conservation of ecosystems defined by geophysical settings puts more emphasis on accommodating dynamic

processes, maintaining ecological function and building adaptive capacity. These new approaches allow for species distributions to shift, and for novel communities to form, while still conserving the maximum biodiversity. This approach would conserve the ecological “stage” rather than the temporary “actors.” This approach would need to be a combined strategy to insure that the actors are able to move between stages.

In some cases, voluntary acquisition of land by public agencies or private conservation organizations is an appropriate conservation alternative. With less than 3% of the state in public conservation lands, Nebraska has one of the lowest percentages of public land in the country. A large proportion of the state's public land is in the Sandhills and the northwestern corner of the state, leaving many natural communities under-represented or not included at all as public trust lands. Acquisition of under-represented natural communities from willing sellers by private or public conservation groups would help ensure the long-term conservation of biological diversity. In addition, 25% of the Tier I at-risk species have no documented occurrences on public lands and therefore are not ensured long-term habitat protection. A number of these species may have habitat management requirements that are not conducive to achieving an economic return. Thus, public or private conservation ownership may be the most practical way to maintain some species. To be acceptable to the public, these acquisitions should ensure that payments are made in lieu of property taxes to maintain the local tax base. Public lands have the additional benefits of meeting recreational, educational, research and other societal needs.

There is also a need to improve management on existing public and private conservation lands so that the needs of a greater array of species can be met. Public land managers and private conservation groups often lack the financial and human resources to adequately manage their lands for biological diversity. Demands on managers' time to control invasive species and administer public use often leave little additional time to restore or manage natural communities. Insufficient capacity to monitor and evaluate management activities and a lack of information about species habitat requirements and management alternatives serve as barriers to improved conservation land management. These issues need to be addressed so that public and private conservation organization lands can more fully contribute to the conservation of our natural heritage.

Actions Needed to Improve the Network of Public and Private Conservation Lands:

1. Identify and secure long-term protection for unique or high quality natural communities through actions such as conservation easements, land exchanges, voluntary acquisition, or conservation buyer programs.
2. Identify and conserve corridors or “stepping stones” to allow for species movements in response to climate change.
3. Promote land acquisition policies that are founded on willing-seller/willing buyer principles, maintain the local tax base, and provide equitable compensation to landowners.

4. Start a natural areas program (modeled after successful programs in other states) that identifies and protects biologically unique sites that are managed to perpetuate Nebraska's biological diversity.
5. Encourage and support the formation of new or expansion of existing land trusts to acquire and manage conservation easements that conserve biological diversity in Nebraska.
6. Improve or change management on public lands to better protect, enhance, and sustain biological diversity and natural communities.
7. Establish voluntary cooperative agreements with private landowners adjacent or near existing public or private conservation lands to facilitate large-block management for conservation and recreation. Provide financial incentives, technical expertise, and recognition to landowners willing to enter into management agreements.
8. Create a forum whereby landowners, community leaders, and conservation practitioners can discuss land management issues and observe management practices in use on public lands. Use the forum to engage in collaborative problem-solving.
9. Facilitate the long-term protection of biologically important lands enrolled in short-term conservation programs (e.g., Conservation Reserve Program, private lands programs) through conservation easements.
10. Seek opportunities to improve management on publicly-owned lands that are not part of the conservation network (e.g., Bureau of Education Land Fund holdings) to increase benefits to biological diversity.
11. Support efforts to provide voluntary public access to private conservation lands that are managed for biological diversity.

Demonstrate Success

Components of at-risk species conservation include demonstrating successful habitat management and sharing this story with the public. Engaging local communities is a necessary component of establishing the Nebraska Natural Legacy Project statewide as a guide for conservation. When local communities are engaged in local conservation initiatives, there is greater understanding of at-risk species conservation, willingness to participate in conservation actions, and greater collaboration among landowners and conservation practitioners. This sets the stage for collaborative habitat improvement projects that cross ownership boundaries.

One way to demonstrate success and engage local individuals is through demonstration sites. There are many conservation projects and lands across Nebraska that offer improved wildlife habitat. Natural Legacy Demonstration Sites should capture Nebraska's representative habitat types and management that is currently fostering the mission of the state wildlife action plan. Demonstration sites need to provide habitat for at-risk species and the support

necessary for sustainable management. Demonstration sites should be open for the public to view conservation projects and results and learn more about a site's unique qualities, importance to at-risk species, and management practices that sustain biological diversity.

Actions Needed to Demonstrate Success:

1. Establish Natural Legacy Demonstration Sites across Nebraska.
2. Advertise Natural Legacy Demonstration Sites and hold regular meetings to discuss management and at-risk species conservation.
3. Support conservation management actions at these locations.
4. Develop informational materials branded with the Nebraska Natural Legacy Project suitable for each location.

The following sites have been selected as Nebraska Natural Legacy Demonstration Sites based on their locations across the state and potential for public demonstrations.

Natural Legacy Demonstration Sites:

1. Fort Robinson State Park
2. Ponderosa Pine Wildlife Management Area
3. Niobrara Valley Preserve
4. Niobrara River State Park
5. Ponca State Park
6. Wildcat Hills
7. Crescent Lake National Wildlife Refuge
8. Calamus Wildlife Management Area and State Recreation Area
9. Boyer Chute National Wildlife Refuge
10. Lake McConaughy
11. Enders Reservoir
12. Lillian Annette Rowe Bird Sanctuary
13. Platte River Prairies
14. Kissinger Basin Wildlife Management Area
15. Saline Wetland Complex
16. Schramm Park State Recreation Area
17. Spring Creek Prairie
18. Rock Glen Wildlife Management Area and Rock Creek Station
State Historical Park
19. Burchard Lake Wildlife Management Area
20. Indian Cave State Park

Increase Participation in Nature-based Recreation

Broad participation in nature-based recreation (e.g., wildlife and wildflower viewing, hunting, fishing, canoeing) has social, ecological, and economic benefits. According to the 2004 NASIS survey, 77% of Nebraskans felt it was very important that people have an opportunity to view wildlife and 66% felt it was very important that people have the opportunity to hunt and fish. Increasing opportunities for high quality, nature-based recreation will help establish or maintain personal connections to biological diversity, motivate individuals to support conservation efforts, and meet an obligation to provide recreation to the state's citizens.

Without sustainable populations of wildlife and intact natural communities, opportunities for nature-based recreation are severely diminished. Nature-based recreation can serve as a strong incentive for conserving biological diversity. However, without adequate controls, recreation and conservation can be in conflict. Nature-based recreation must be appropriately managed and at times controlled to limit impacts to species and habitats and to maintain quality recreational experiences.

The economic diversification that can result from nature-based recreation or natural amenities can help provide a much-needed boost to rural communities. Many Nebraska communities are facing long-term declines that are leading to economic stagnation. Community leaders are seeking new and innovative ways to reverse this decline. The high level of interest in the Nebraska Birding Trails initiative is one example of how nature-based tourism is seen as a partial solution to economic troubles. For biological diversity conservation to succeed, it will be necessary for conservation decision-makers, community leaders, and businesses to collaboratively develop a long-term sustainable economic vision that includes conservation of the state's natural assets.

Actions Needed to Increase Participation in Nature-based Recreation:

1. Collaborate with agencies, private organizations, and communities to develop new and enhance existing wildlife-viewing infrastructure (e.g., roadside pull-offs, interpretive signage, viewing platforms). Promote the use of wildlife viewing sites through the media and established networks of nature enthusiasts.
2. Develop resources and a support system to assist communities with sponsorship of wildlife-related events (e.g., eagle viewing days, crane celebrations, hunter breakfasts, fishing tournaments) that have recreational, educational, and entertainment value and provide community economic benefits.
3. Identify sites conducive to greenway development and provide resources and support to help communities engage in collaborative planning to develop long-term strategies that meet conservation, economic, and recreational goals.
4. Develop and support programs that increase the number of individuals who are knowledgeable about and committed to promoting nature-based recreational opportunities. Support the establishment of naturalist programs in state parks and other recreational areas.

5. Develop partnerships with landowners to provide wildlife viewing (e.g., birding trails), hunting, and fishing opportunities on private lands and seek to provide fair compensation for providing these services. Develop collaborative eco-tourism marketing plans for different regions of the state that can be used to expand nature-based tourism and increase economic sustainability.
6. Develop and populate a database of private and public nature-based recreation sites. Make the information available to the public in a user-friendly manner through social media, websites, current popular technology and/or a printed publication.
7. Distribute educational materials for nature-based users that identify potential problems associated with recreation use (e.g., ATV's, impacts of boaters, wildlife viewing disrupting wildlife.)